

WHAT IS CLAIMED IS:

1. A suspension system for a vehicle having a frame, the suspension
5 system comprising:
an axle; and
a beam interconnected between the vehicle frame and the axle, the beam
having opposite ends, an elongated body extending between the opposite ends,
and a metal end connection at one of the opposite ends, the body being made of a
10 composite material.
2. The suspension system according to claim 1, wherein the end
connection is a frame pivot connection.
- 15 3. The suspension system according to claim 1, wherein the end
connection is an axle connection.
4. The suspension system according to claim 3, wherein the axle is
made of an axle composite material.
- 20 5. The suspension system according to claim 1, wherein the end
connection has a cavity formed therein, the body being received in the cavity.

6. The suspension system according to claim 1, wherein the end connection is received internally in the body.

5 7. The suspension system according to claim 1, wherein the body has a nonuniform distribution of fibers in the composite material.

8. The suspension system according to claim 1, wherein the body has a generally I-shaped cross-section.

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9. The suspension system according to claim 8, wherein flanges of the I-shaped cross-section have a greater density of fiber than a web of the cross-section extending between the flanges.

15 10. The suspension system according to claim 1, wherein the body has a generally H-shaped cross-section.

11. The suspension system according to claim 10, wherein upper and lower end portions of flanges of the H-shaped cross-section have a greater
20 density of fiber than a web of the cross-section extending between the flanges.

12. The suspension system according to claim 1, wherein the body has a generally tubular cross-section.

13. The suspension system according to claim 12, wherein upper and
5 lower wall portions of the tubular cross-section have a greater density of fiber than central wall portions of the cross-section.

14. The suspension system according to claim 1, wherein the end connection includes a sleeve attached to a body coupling structure.

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15. The suspension system according to claim 14, wherein the structure receives the body internally therein.

16. The suspension system according to claim 14, wherein the body
15 receives the structure internally therein.

17. The suspension system according to claim 14, wherein the sleeve and body coupling structure are integrally formed.

20 18. The suspension system according to claim 14, wherein the sleeve encircles a pivot bushing.

19. The suspension system according to claim 18, wherein the pivot bushing pivotably connects the end connection to the vehicle frame.

20. The suspension system according to claim 18, wherein the pivot bushing pivotably connects the end connection to the axle.

21. The suspension system according to claim 14, wherein the sleeve extends at least partially about the axle.

22. The suspension system according to claim 1, wherein the end connection includes an axle coupling structure attached to the axle, and a body coupling structure attached to the body.

23. The suspension system according to claim 22, wherein the body coupling structure receives the body internally therein.

24. The suspension system according to claim 22, wherein the body receives the body coupling structure internally therein.

25. The suspension system according to claim 22, wherein the axle coupling structure and the body coupling structure are integrally formed.

26. The suspension system according to claim 22, wherein the axle coupling structure extends at least partially about the axle.

27. The suspension system according to claim 22, wherein the axle
5 coupling structure is pivotably attached to the axle.

28. The suspension system according to claim 22, wherein the axle is made of a composite material.

29. A suspension system for a vehicle having a frame, the suspension system comprising:

an axle; and

a beam interconnected between the vehicle frame and the axle, the beam
5 having opposite ends, an elongated body extending between the opposite ends,
an axle end connection at one of the opposite ends, and a frame end connection
at the other of the opposite ends, the body being made of a composite material
and having a cross-section with at least two flanges and a web extending between
the flanges.

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30. The suspension system according to claim 29, wherein the flanges
wrap outwardly about the axle end connection.

31. The suspension system according to claim 29, wherein the flanges
15 are attached to an axle coupling structure of the axle end connection.

32. The suspension system according to claim 31, wherein the structure
is rigidly attached to the axle.

20 33. The suspension system according to claim 31, wherein the structure
is pivotably attached to the axle.

34. The suspension system according to claim 31, wherein the structure extends at least partially about the axle.

35. The suspension system according to claim 31, wherein the structure
5 is welded to the axle.

36. The suspension system according to claim 31, wherein the axle is made of an axle composite material.

10 37. The suspension system according to claim 29, wherein the flanges are attached directly to the axle.

38. The suspension system according to claim 37, wherein the web is attached directly to the axle.

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39. The suspension system according to claim 37, wherein the flanges extend at least partially about the axle.

40. The suspension system according to claim 37, wherein the axle is
20 made of an axle composite material.

41. The suspension system according to claim 29, wherein the flanges wrap outwardly about the frame end connection.

42. The suspension system according to claim 41, wherein the flanges
5 are attached to a frame coupling structure of the frame end connection.

43. The suspension system according to claim 42, wherein the frame coupling structure extends about a pivot bushing.

10 44. The suspension system according to claim 29, wherein the flanges have a greater density of fiber than the web.

45. The suspension system according to claim 29, wherein upper and lower end portions of the flanges have a greater density of fiber than the web.

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46. The suspension system according to claim 29, wherein the body cross-section is generally I-shaped.

47. The suspension system according to claim 29, wherein the body
20 cross-section is generally H-shaped.

48. The suspension system according to claim 29, wherein the frame end connection includes a structure which straddles a hanger bracket attached to the vehicle frame.

5 49. The suspension system according to claim 29, wherein at least one of the axle and frame end connections is made of metal.

50. The suspension system according to claim 29, wherein each of the axle and frame end connections is made of metal.

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51. The suspension system according to claim 29, wherein at least one of the axle and frame end connections has a cavity formed therein, the body being received in the cavity.

15 52. The suspension system according to claim 29, wherein the body has a nonuniform distribution of fiber therein.

53. The suspension system according to claim 29, wherein the axle is made of a composite material.